United States
Department of
Agriculture

Forest
Service

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Appendix D

MORRISON RUN PROJECT

Project-Level Projections for Future Oil and Gas Development

Bradford Ranger District, Allegheny National Forest

Introduction

This document describes three scenarios for future private oil and gas development (OGD) in the Morrison Run project area. These scenarios incorporate information on past project- and forest-level private OGD but make different assumptions regarding how past development trends predict likely future activities. Therefore, the scenarios encompass a range of potential development patterns that the Responsible Official evaluated when determining the intensity and spatial pattern of OGD that could be considered as reasonably foreseeable private activities in the cumulative effects analysis for the Morrison Run Project. The scenarios below generate estimates for shallow oil and gas well development; reasonably foreseeable deep shale gas operations are discussed after the three shallow well scenarios.

Detailed supporting information and descriptions of the methodologies used to generate the scenarios below can be found in two unpublished documents, the *Programmatic Effects of Private Oil and Gas Activity on the Allegheny National Forest* (USDA-FS 2010a) and *Site-Specific Effects of Private Oil and Gas Development on the Allegheny National Forest* (USDA-FS 2010b). These documents are considered the best available information on OGD on the Allegheny National Forest (ANF) and are in the project file for the Morrison Run Project located at the Bradford Ranger District Office.

Assumptions for scenario development

The Final Environmental Impact Statement (FEIS) for the ANF Forest Plan listed general assumptions for estimating OGD and its effects (USDA-FS 2007b, FEIS – Appendix F, p. F-12). The two unpublished documents listed above revised some of these assumptions based on OGD after 2005 and more detailed data analysis. The scenarios below all use the following facts and general assumptions from these documents as well as site-specific assessments of the Morrison Run project area:

- There were an estimated 1,189 wells in the 19,705 acres of the Morrison Run project area in 2010 (density of one well per 16.6 acres).
- Existing and projected OGD on other lands (e.g., private or state) is proportional to that on ANF lands (USDA-FS 2010a, Attachment 2, p. 23).
- On average, each existing well directly impacts approximately 1 acre. The ANF Forest Plan FEIS (Appendix F, p. F-12) states that existing OGD includes 0.156 mile of road per well. Using a 35 feet clearing limit for roads, the acres of disturbance connected with the road required for each well is approximately 0.7 acre. The well pad itself contributes an additional 0.3 acres of direct impact.
- On average, new OGD directly impacts approximately 1.3 acres per well (includes well, road, tank batteries, and associated pipelines). For each new well drilled, an estimated 0.3 acre is cleared for the well pad and an additional one acre is cleared for the access roads, tank batteries, and associated pipelines (ANF Forest Plan FEIS, p. 3-5 and USDA-FS 2010a, Attachment 2, p. 23).
- Plugging of abandoned wells would not reduce future well development.
- The projections for development will be relevant over the time frame for analysis of cumulative effects for the Morrison Run Project (2011-2030).

The future condition is calculated by adding the current number of wells (1,189) and the predicted future development for each scenario.

Scenario 1: Forest-wide average development calculated for project area

The average rate of OGD from 1986 to 2005 was 225 wells per year across the entire Forest with a maximum quarterly rate of 800 wells per year (USDA-FS 2010a, Attachment 2, p. 18, Table 3). Averaging these two measures of OGD produces an estimate of 512 wells per year. Across the entire area of the ANF, this is a development rate of approximately 0.001 new wells per acre per year. This rate was used to estimate future well development within the Morrison Run project area for the cumulative effects time frame.

Projected future well development:

Project area (19,705 acres) x 0.001 wells per year per acre x 20 years = 394 new wells

Acres directly impacted: 564 wells x 1.3 acres/well = 512 acres

Future condition: 1,583 wells, 1,701 acres impacted

Scenario 2: Recent development in the project area

From 2006 to 2009, an average of 868 new wells per year was developed across the ANF (USDA-FS 2010a, p. 18). This rate of development is much higher than in the preceding 20 year period used in Scenario 1 above, but development did not occur evenly across the Forest. In the 10 years before this analysis was conducted in 2010, 812 new wells were developed on National Forest System lands within the project area at (data from personal communication with ANF oil and gas administrators). Scenario 2 estimates future development by calculating this rate of development (81.2 wells per year) for the project area during the cumulative effects time frame.

Projected future well development:

81.2 wells per year x 20 years = 1,624 new wells

Acres directly impacted: 1,624 wells x 1.3 acres per well = 2,111 acres

Future condition: 2,813 wells, 3,300 acres impacted

Scenario 3: Full field development

This scenario used GIS to identify a potential layout for future private OGD based on current and proposed well locations combined with known geologic, geographic, cultural and water features that would likely restrict OGD within the project area (see map below). This scenario is not meant to predict the site of any individual well, but to generate a reasonably foreseeable spatial pattern of future development based on the best available information. A

description of the methods and assumptions for developing this scenario is in the *Programmatic Effects of Private Oil and Gas Development on the Allegheny National Forest* (USDA-FS 2010a, Attachment 2, p. 18-20).

This scenario does not identify likely locations of wells on private land and does not estimate the rate of new well development or the total time period over which development would occur. For estimating future OGD on private land, it is assumed that development would occur at the same rate as on the Forest Service land in the project area. For purposes of analysis and for consistency with the other scenarios, it is assumed that full field development would occur within the cumulative effects time frame.

Project area

Projected future well development: 608 new wells (589 on 19,098 acres of Forest Service land and 19 on 607 acres of private land in the project area)

Acres directly impacted: 608 wells x 1.3 acres per well = 790 acres

Future condition: 1,797 wells, 1,979 acres impacted

The methods used to generate Scenario 3 for the project area were also used to estimate the number of wells that are likely to be developed in the cumulative effects areas for transportation/recreation and wildlife/hydrology, both of which extend beyond the boundary of the Morrison Run Project. The project boundary was the cumulative effects boundary for the other resources analyzed in the Morrison Run EA.

Wildlife and Hydrology cumulative effects area

Current condition: 1,946 wells on 29,120 acres (21,563 acres ANF land, 7,557 acres private land)

Projected future well development: 878 new wells (650 on NFS land, 228 on private land)

Acres directly impacted: 878 wells x 1.3 acres per well = 1,141 acres

Future condition: 2,824 wells, 3,087 acres impacted

Transportation and Recreation cumulative effects area

Current condition: 1,946 wells on 28,241 acres (21,921 acres ANF land, 6,919 acres private land)

Projected future well development: 828 new wells (629 on NFS land, 199 on private land)

Acres directly impacted: 828 wells x 1.3 acres per well = 1,076 acres

Future condition: 2,573 wells, 2,821 acres impacted

Scenario selection and rationale

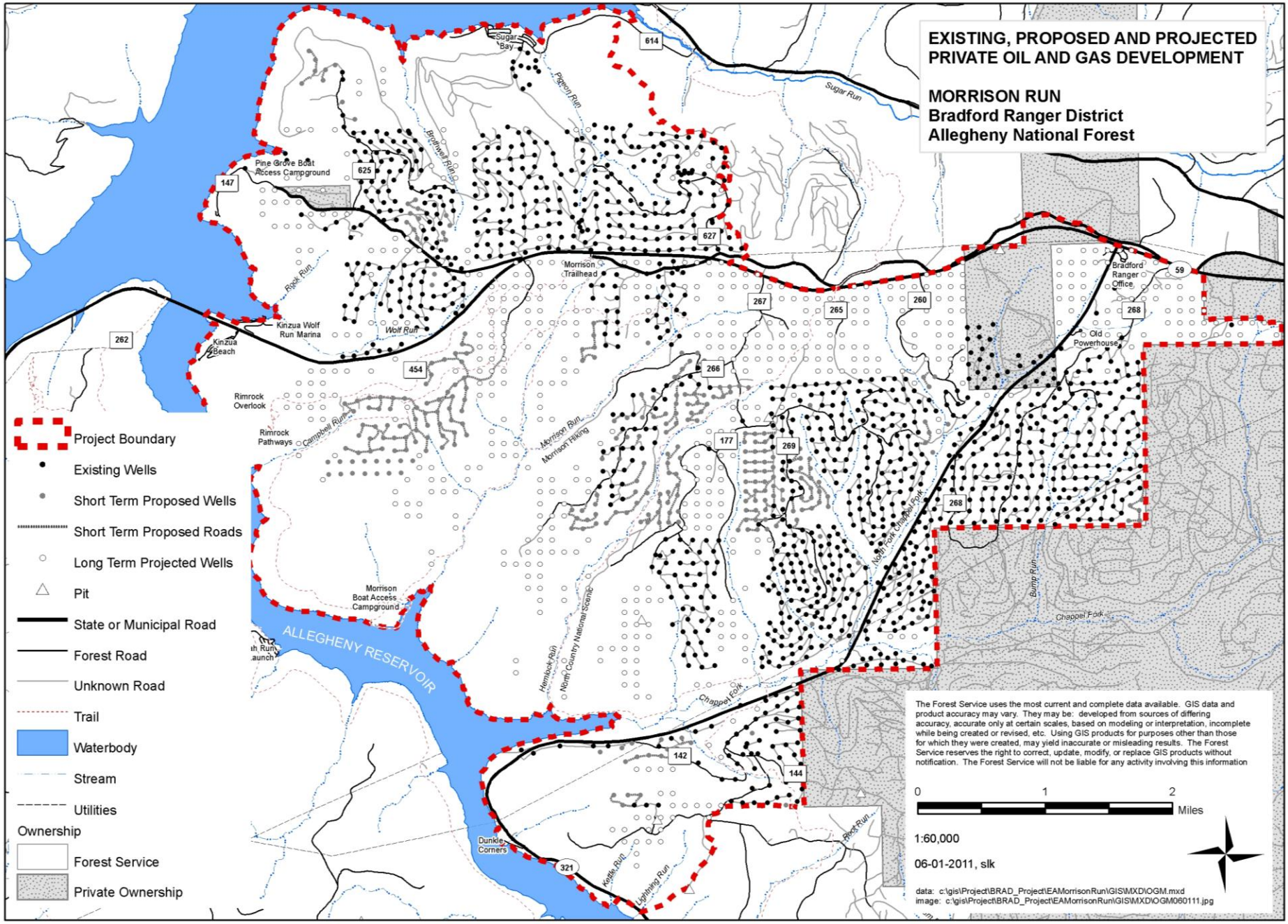
Based on the information presented in the scenarios above and assessment of the Morrison Run project area, the Responsible Official determined that Scenario 3 best estimated reasonably foreseeable private oil and gas development.

Scenario 1 and 2 generated less informed predictions because neither considered site-specific factors that could affect the spatial pattern of future development. For example, development of over 1,600 new wells projected by Scenario 2 is unlikely in the project area due to space limitations. By contrast, Scenario 3 used site-specific data regarding geological formations, existing private OGD and surface features that would likely affect development of individual well sites. Therefore, despite the uncertainty associated with predicting future private activities, the Responsible Official determined that the methods used for developing Scenario 3 were sufficiently rigorous for describing reasonably foreseeable future oil and gas development for the Morrison Run Project. Note that this scenario does not propose, approve or regulate private oil and gas development.

Deep shale gas development

The selected scenario is only applicable to shallow well development. However, deep shale gas operations accessing the Marcellus and Utica formations are also being developed on the Allegheny National Forest and adjacent private land. These operations generally involve development of a 5-10ac well pad for multiple wells and associated equipment. The environmental effects of deep shale gas developments are described in the *Programmatic Effects of Private Oil and Gas Activity on the Allegheny National Forest* (USDA-FS 2010a).

At the time of this analysis, one shale gas operation was proposed in the Morrison Run area. It is possible that more deep shale gas sites will be developed in the cumulative effects analysis time frame for this project. However, because these developments are new to the area and still largely exploratory, it is difficult to predict the rate of development or location of shale gas well sites.


EXISTING, PROPOSED AND PROJECTED PRIVATE OIL AND GAS DEVELOPMENT
MORRISON RUN
Bradford Ranger District
Allegheny National Forest
Project Boundary
Existing Wells
Short Term Proposed Wells
Short Term Proposed Roads
Long Term Projected Wells
Pit
State or Municipal Road
Forest Road
Unknown Road
Trail
Waterbody
Stream
Utilities
Ownership
Forest Service
Private Ownership
ALLEGHENY RESERVOIR
Sugar Bay
Pine Grove Boat Access Campground
Kinzua Wolf Run Marina
Kinzua Beach
Rimrock Overlook
Rimrock Pathways
Morrison Boat Access Campground
Morrison Trailhead
Bradford Ranger Office
Old Powerhouse
Dunkle Corners
Pigeon Run
Sugar Run
Bradford Run
Rock Run
Wolf Run
Campbell Run
Morrison Run
Morrison Hiking
Hemlock Run
North Country National Scenic
Chappel Fork
Bump Run
Black Run
Kettle Run
Lightning Run
614
625
147
627
262
454
267
265
260
59
268
266
177
269
142
144
321
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